

Abstract Submitted
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Observation of the instantaneous velocity of a Brownian Particle SIMON KHEIFETS, TONGCANG LI, DAVID MEDELLIN, MARK RAIZEN, University of Texas at Austin — A notable feature of Brownian motion is that it is self-similar for all time scales. However, at short enough time scales, a particle at thermal equilibrium follows straight line trajectories with a well-defined velocity. The time scale at which the transition occurs between ballistic and Brownian motion is set by the momentum relaxation time, τ_p . We have measured the position of an optically trapped particle in air with temporal resolution much faster than τ_p , and have thus observed the transition between ballistic and diffusive Brownian motion and measured the instantaneous velocity of a Brownian particle for the first time. This has allowed us to directly verify the energy equipartition theory for Brownian motion. We are currently working towards observing the instantaneous velocity of a particle in water, for which τ_p is several orders of magnitude smaller.

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